

PolyMet EIS
Cooperating Agencies Mercury Issues Session

Projected PolyMet Mercury Contributions

Air Media
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Water Media
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Air Media Outline

- Sources of airborne mercury emissions
- Proposed mercury controls
- Controlled mercury air emissions
- Cumulative mercury air modeling and deposition
- Mercury TMDL proposal

Mercury Emissions Sources

Origins of Mercury

- Ore
- Fuel

Mercury Emissions Sources

- Autoclave
- Ore crushing and grinding equipment
- Fugitive dust emissions
- Gaseous fuels for space heating and process

Mercury Mitigation and Control

Autoclave

- Venturi scrubber and a packed bed scrubber
- 25% control for elemental mercury
- 90% control for particle bound and oxidized mercury

Fugitive Dust

- Required work practices to eliminate fugitive dust

Ore Crushing and Grinding

- Particle-bound mercury
- Baghouses and cartridge filters with some HEPA filters

Gaseous Fuels

- Lowest Hg content option

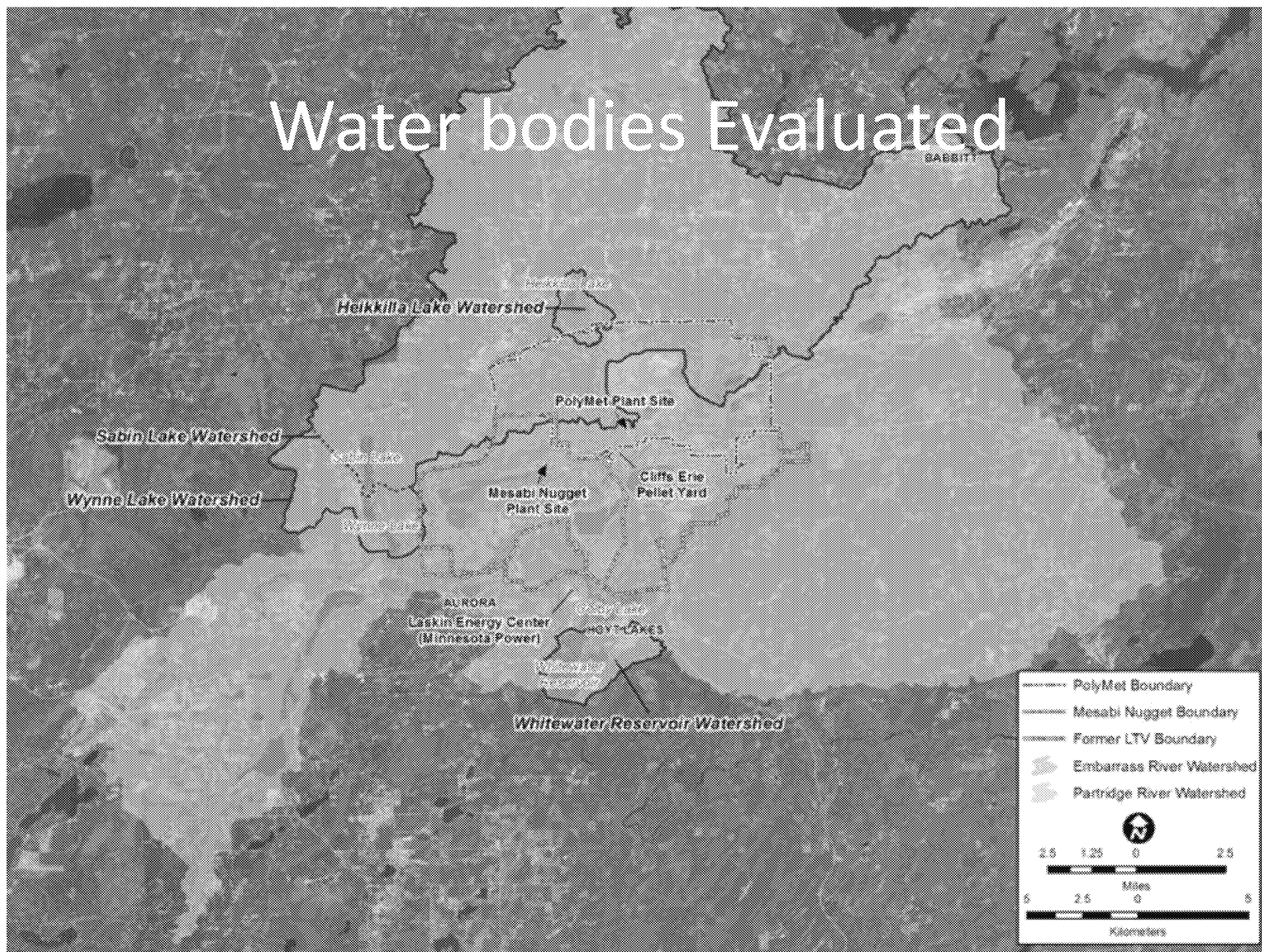
Controlled Mercury Emissions

Source	Lb Hg/Year
Autoclave	4.1
Ore crushing and grinding equipment	0.001
Fugitive dust emissions	0.1
Gaseous fuels for space heating and process	0.5
Total	4.6

Cumulative Mercury Deposition

- Considers impacts of PolyMet and Mesabi Nugget
 - PolyMet: 4.6 lb Hg/yr
 - Nugget: 75 lb Hg/yr
- Uses Minnesota Mercury Risk Estimation Method (MMREM)
- Predicts the impact of increased mercury loading and change in fish mercury concentrations

Water bodies Evaluated



Cumulative Mercury Deposition Results

- Increase mercury concentrations in fish in the nearest lakes between 0.3 percent to 1.8 percent over current levels
- The current levels of mercury in the fish in selected nearby lakes already exceed the levels that trigger a fish consumption advisory
- Does not consider the statewide mercury TMDL reductions

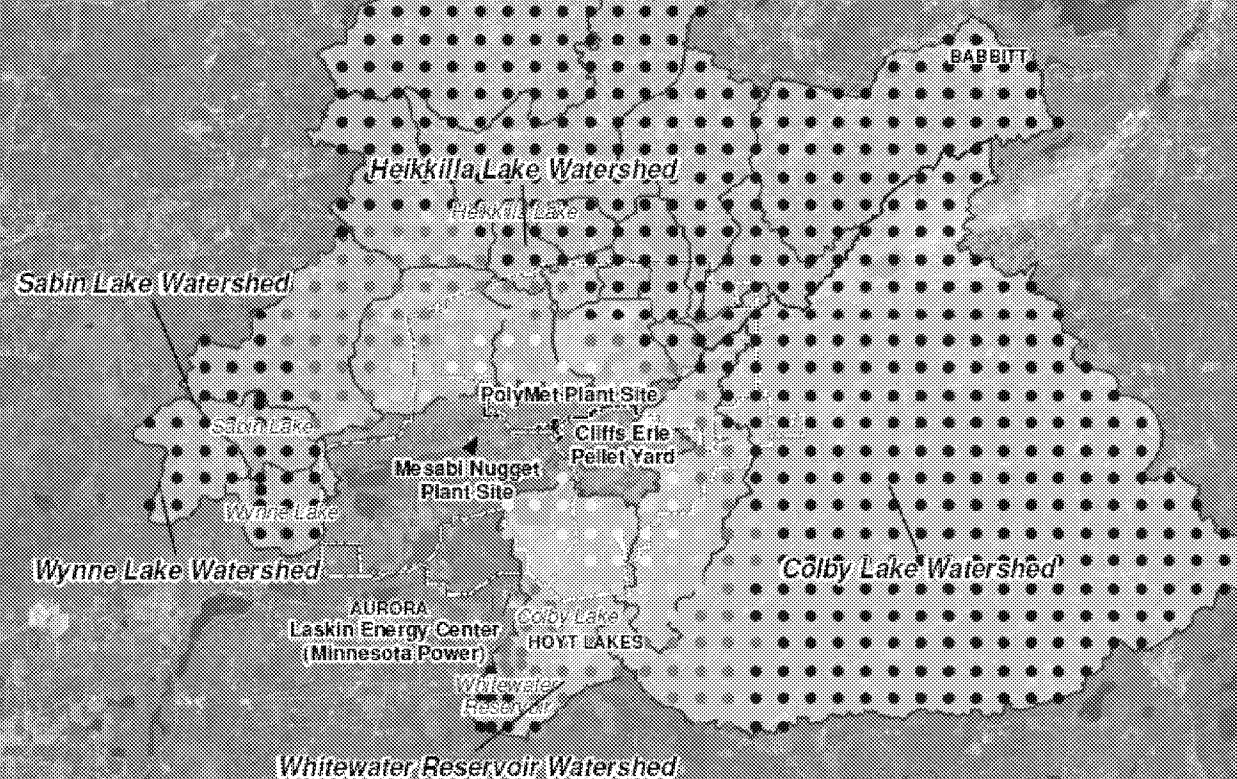
Nugget and PolyMet Dispersion Modeling Results

Annual Concentration (ug/m3)

- 0.000e+000 - 5.000e-006
- 5.001e-006 - 7.000e-006
- 7.001e-006 - 9.000e-006
- 9.001e-006 - 1.000e-005
- 1.001e-005 - 1.500e-005
- 1.501e-005 - 2.000e-005
- 2.001e-005 - 2.305e-005

Embarrass River Watersheds

Partridge River Watersheds



Kilometers
5 0 5

Figure 4

CUMULATIVE ANNUAL HG
Scenario 1 Results
NorthMet Project
Hoyt Lakes, MN

Hazard Quotient

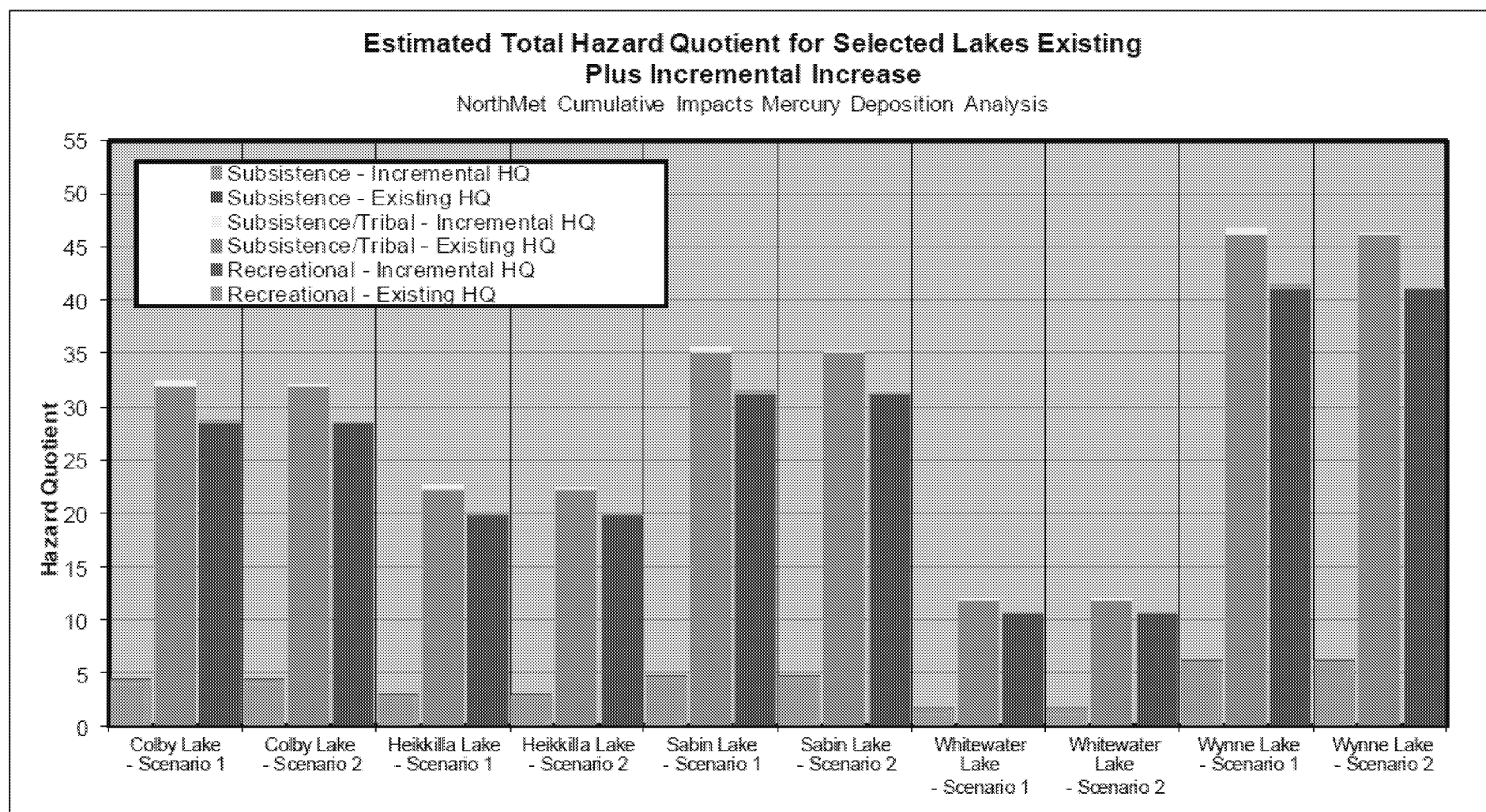


Figure 9 Total Hazard Quotient (Existing Plus Incremental) NorthMet Cumulative Impacts Mercury Deposition Analysis

State-wide Mercury TMDL New and Modified Sources

- > 3 lb Hg/yr triggers New and Modified Sources guidance
- All six elements of the guidance need to be considered

Equivalent Mercury Reductions

Goals

- Focus on northeast Minnesota
- Mercury collection that can be verified/documented
- Mercury sources that have not been previously focused on
- “Above and beyond” existing mercury collection programs

Options

- Partnerships with Non-Profits/Re-Stores
- Northeastern Minnesota Clean Sweeps
- Building Construction and Demolition Companies
- Rail Facility Collection Projects
- On-site “Clean Sweep”

Summary

- 4.6 lb Hg/yr emissions expected
- Nearby water bodies are already impaired for mercury
- Statewide Mercury TMDL requires mitigation, including equivalent mercury reductions equal to the facility's emissions

Water Media Outline

- Hg Mass balance
 - Plant site
 - Mine site
- Plant Site Sulfate

Plant Site Hg Mass Balance

- Simple estimation method used over mechanistic approach
- Major Hg inputs for plant site/FTB:
mining; ore concentrating; pressure oxidation leaching; product recovery; and handling
- Major Hg outputs for mining facility:
hydrometallurgical processing residue; air emissions; and tailings

Tailings Basin Hg Estimates

- Annual Project load to the tailings basin:
Estimated 16 lbs/yr (2-3% LTVSMC)
- Tailings provide Hg sorption
- Reduced deep seepage Hg concentration
- Hg expected to meet or exceed 1.3 ng/L water quality standard (same as existing condition)
- Any direct surface discharge to be treated by WWTP using RO
- See Plant Site Data Package – Section 5.6

Mine Site Hg Mass Balance

- Simple estimation method used over mechanistic approach
- West Pit – Mixing only in upper 30 feet
- East Pit – two zones to West Pit:
 - overflow from East Pit wetland
 - subsurface or GW flow from East Pit to West
- Pit wall rock and backfilled waste rock – no Hg adsorption or release
- Average concentration for GW assumed

West Pit Mass Balance Terms - Inputs

- Precipitation
- Cat 1 Waste Rock Stockpile Drainage
- Watershed Runoff
- Groundwater Inflow
- East Pit Flow (from wetland)
- East Pit Flow (from groundwater)
- Atmospheric Dry Deposition

West Pit Mass Balance Terms - Losses

- Burial
- Evasion/Volatilization

Backfilled East Pit Mass Balance Terms - Inputs

- Precipitation
- Watershed Runoff
- Groundwater Inflow
- Discharge from WWTP
- Atmospheric Dry Deposition

Backfilled East Pit Mass Balance Terms: Losses

- Burial
- Evasion/Volatilization
- Groundwater/Surface Water Outflow to West Pit
- Groundwater Outflow to South/East

Mine Site Mass Balance Results

- Mine site mass balance has not been run
- West Pit overflow projected approximately 40 years out from closure
- Overflow discharge must comply with 1.3 ng/L standard
- See Mine Site Data Package – Section 5.8

Plant Site Sulfate & MeHg

- Sulfate reduction tied to methyl mercury production under some conditions
- Wetlands north of FTB may constitute a “high risk” setting for MeHg production
- Assumed that some sulfate reduction is occurring within Embarrass River and surrounding wetlands
- Proposed modeling will not estimate downstream sulfate concentrations
- Model results will be interpreted in terms of spatial or temporal changes

Plant Site Sulfate Impact Criteria

- No increase in sulfate loading from existing conditions at PM-11 (Unnamed Creek), PM-19 (Trimble Creek), and MLC-2 (Mud Lake Creek);
- A decrease in the concentration of sulfate in the Embarrass River at PM-13 from existing conditions; and
- No statistically significant increase in sulfate concentration in the Embarrass River from upstream of the facility (e.g., PM-12.2) to downstream of the facility (e.g., PM-13)

Surface Water Evaluation Points

[Taken from Large Figure 7 – Plant Site Data Package]



Plant Site Sulfate Impact Criteria (cont.)

- Criteria are based on Agency Draft Alternative from summer 2011
- Possible for criteria to change as a function of new engineering controls
- Any changes to criteria will reflect potential for new MeHg production

Plant Site Sulfate & MeHg

- No methyl mercury modeling proposed
- This is beyond the state-of-the-art
- Qualitative assessment to be provided based on FTB sulfate impact criteria
- Meeting criteria viewed as maintaining status quo or better
- Results considered in permitting
- See Plant Site Data Package – Section 5.9

Summary

- Plant site discharges must meet 1.3 ng/L standard
- Mine site discharges must meet 1.3 ng/L standard
- FTB sulfate contributions to high risk wetlands must not exceed current contributions
- No increase or reduced FTB sulfate contribution to Embarrass River